Recent advances in extensional rheology: controlled flows and fracture

Hassager, Ole; Huang, Qian

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

EIGHTH INTERNATIONAL SYMPOSIUM

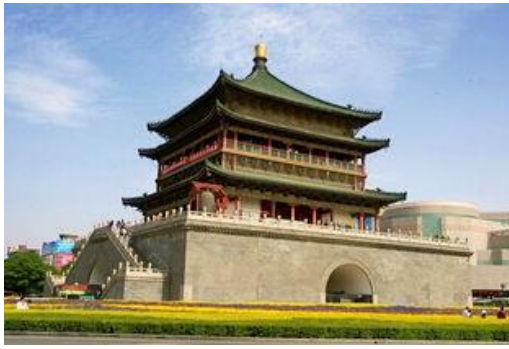
ON ENGINEERING PLASTICS

EP 2017

Xi'an, China

August 8-11, 2017

Program



Organized by

Institute of Chemistry, Chinese Academy of Sciences

Xi'an Jiaotong University

Sponsored by

Ministry of Science and Technology, China

National Natural Science Foundation of China (NSFC)

Chinese Academy of Sciences (CAS)

Polymer Division, Chinese Chemical Society (CCS)

RECENT ADVANCES IN EXTENSIONAL RHEOLOGY: CONTROLLED FLOWS AND FRACTURE.

Ole Hassager, Qian Huang.
Department of Chemical and Biochemical Engineering, Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark

Extensional deformation and flow occur in a number of polymer processing operations such as fiber spinning and film blowing. To understand and analyze material behavior in such operations, accurate and quantitative measurements of the rheological properties in well-defined extensional deformations are needed. However, while shear flows may in principle easily be generated in geometries such as cone-and-plate and plate-and-plate, the generation of controlled extensional flows has proven to be a challenge [1]. This presentation will focus on the application of Filament Stretching Rheometry (FSR) to measure extensional flow properties of polymeric liquids. It will be demonstrated, that the FSR technique enables measurements in start-up of constant extensional rate flow to sufficiently large Hencky strain so that steady flow is attained for several polymer systems. In addition the FSR may be used to study the relaxation of stress after cession of flow and the transient extensional creep under conditions of constant stress.

Combination of the FSR technique with other methods gives further possibilities. For example high speed imaging may be used to study and analyze crack profiles under filament fracture [2]. Likewise the deuterium labeling of selected molecules in combination with the FSR allows for the study of molecular relaxation by small angle neutron scattering [3].

References: (ACS format. Times New Roman, 10 pt.)

1. Bird, R. B.; Armstrong, R. C.; Hassager, O. *Dynamics of Polymeric Liquids,Fluid Mechanics*, Wiley, New York (1987).

2. Huang,Q.; Alvarez, N.J.; Shabbir,A; Hassager,O., *Physical. Review. Letters*, **2016,** 117, 087801

3 Kirkensgaard, J. J. K.; Hengeller, L.; Dorokhin, A.; Huang, Q.; Garvey, C. J.; Almdal, K.; Hassager, O.; Mortensen, K., *Physical Review E.*,**2016,** 94, 020502(R).